

## HABITAT CHARACTERISTICS OF GREAT GRAY OWL SITES IN THE SISKIYOU MOUNTAINS OF SOUTHWESTERN OREGON

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ABSTRACT.—Great Gray Owls (*Strix nebulosa*) were located at 92 sites, 1991–97, on the northern slopes of the Siskiyou Mountains of southwestern Oregon. We characterized habitat at the 28 sites including locations with nests (10), recently-fledged young (5), pairs (10), and multiple-year observations (3). Unique to Great Gray Owl populations in western North America, 90% of the nests and 63% of all observations occurred below 915 m in elevation. Owls occurred most often in stands of mature and old growth Douglas-fir (*Pseudotsuga menziesii*) adjacent to open canopy woodland, chaparral, and natural meadows. Oregon white oak (*Quercus garryana*) was the dominant tree in the woodlands. Three species associated with woodlands and meadows, California voles (*Microtus californicus*), moles (*Scapanus* spp.), and Botta's pocket gophers (*Thomomys bottae*) comprised 73.3% of the prey items identified. While all nests were near some relatively open habitat, only four of 10 nests were within 800 m of recent clearcuts. All nests were stick platforms in live trees. The distribution of Great Gray Owls in the Siskiyou Mountains suggests that they may have a broader distribution in the western United States than previously reported, particularly at elevations below 915 m.

KEY WORDS: *Great Gray Owl*; *Strix nebulosa*; food habits; habitat selection; nest sites; Oregon; Siskiyou Mountains.

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### CARACTERÍSTICAS DEL HÁBITAT DEL GRAN BÚHO GRIS EN LAS MONTAÑAS SISKIYOU DEL SURESTE DE OREGON

RESUMEN.—Los grandes búhos grises (*Strix nebulosa*) fueron localizados en 92 sitios entre 1991–97, en las laderas septentrionales de las Montañas de Siskiyou en el sureste de Oregon. Caracterizamos el hábitat en los 28 sitios con nidos (10), volantes (5), parejas (10), y observaciones múltiples anuales (3). Solo para las poblaciones de Grandes Búhos Grises en el oeste de Norteamérica, el 90% de los nidos y el 63% de todas observaciones ocurrieron por debajo de 915 m de elevación. Los búhos se presentaron más frecuentemente en perchas en abetos de Douglas (*Pseudotsuga menziesii*) maduros y viejos, adyacentes a claros de dosel del bosque, chaparrales, y praderas naturales. El roble blanco de Oregon (*Quercus garryana*) fue el árbol dominante en los bosques. Tres especies asociadas con bosques y praderas, *Microtus californicus*, *Scapanus* spp. y *Thomomys bottae* comprendieron el 73.3% de las presas identificadas. Todos los nidos estuvieron cerca de algún hábitat relativamente abierto, sólo cuatro de 10, estaban dentro de 800 m en claros de bosque recientes. Todos los nidos eran plataformas de palos en árboles vivos. La distribución de los grandes búhos grises en las Montañas de Siskiyou sugiere que estos pueden tener una distribución más amplia en el oeste de los Estados Unidos de lo que previamente se conocía, especialmente en elevaciones por debajo de 915 m.

[Traducción de César Márquez]

In the western United States, the Great Gray Owl (*Strix nebulosa*) is a reclusive inhabitant of boreal forests (Franklin 1988). The species is considered an uncommon resident with an uneven distribution extending from the crest of the Cascade Mountains in Washington and Oregon, east to the

Rocky Mountains of western Montana and northwestern Wyoming (Bull and Duncan 1993, Duncan and Hayward 1994). These owls also occur further south in the Sierra Nevada Mountains of California (Winter 1986).

Oregon and California populations are associated with a variety of mature and old-growth coniferous forest habitats near mountain meadows above 915 m. These include true firs (*Abies* spp.), ponderosa and lodgepole pines (*Pinus ponderosa*

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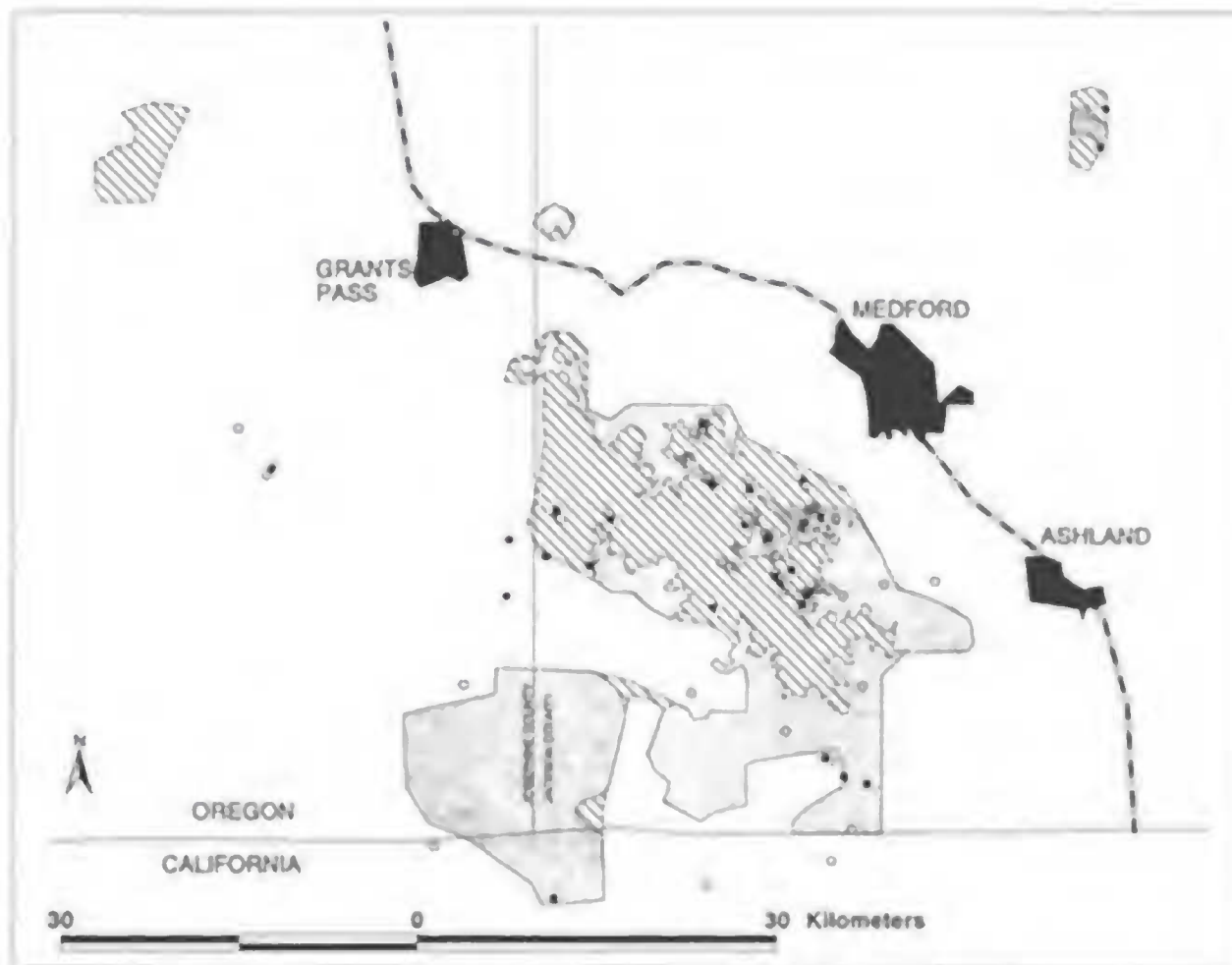


Figure 1. Distribution of Great Gray Owl sightings (1991–97) in the Siskiyou Mountains of southwestern Oregon. Solid circles represent nests, solid squares represent recently-fledged young, pairs, and multiple-year sightings, and open circles represent single observations of individuals. Shaded areas represent surveyed locations >915 m, and crosshatched areas represent surveyed locations <915 m.

and *P. contorta*), and Douglas-fir (*Pseudotsuga menziesii*; Winter 1980, 1986, Bryan and Forsman 1987, Bull et al. 1988b, Goggans and Platt 1992).

Great Gray Owls use montane meadows as preferred hunting areas (Winter 1986) as well as open stands of mature forests with grass as the dominant ground cover (Bull et al. 1988b) and clearcuts (Goggans and Platt 1992). Denser stands of trees are used less frequently.

Nests in the western United States are often in natural depressions in broken-topped snags, but stick nests and artificial platforms are also used (Bull and Henjum 1990, Bull and Duncan 1993). Typically, nests are located within 0.3 km of a meadow or clearcut (Winter 1986, Bryan and Forsman 1987).

In 1991, a population of Great Gray Owls was discovered in the Siskiyou Mountains of southwestern Oregon, west of the previously described range of the species (Johnsgard 1988, Bull and Duncan 1993). The owls in this new geographic area are distinctive because they occur below 915 m in elevation. Therefore, we set out to better understand the habitat used by these owls. In this study, we

characterize the habitat and nesting sites occupied by these Great Gray Owls, which occur 34–85 km west of the nearest previously-known nesting site.

#### STUDY AREA AND METHODS

In 1991, biologists from the Bureau of Land Management (BLM) and United States Forest Service (USFS) began to encounter Great Gray Owls in the Siskiyou Mountains, including several occupied nests. In 1996 and 1997, BLM and USFS biologists surveyed all habitat in a 117 600 ha area for this species in the Siskiyou (Fig. 1). All 75 observations in the surveyed area plus 17 additional sightings outside the survey area were recorded on 7.5 minute United States Geologic Survey (USGS) topographic maps. Surveys were conducted according to procedures outlined in Huff et al. (1996). This protocol directed that surveys be done: (1) within the range of the Spotted Owl (*Strix occidentalis*), (2) at elevations above 915 m, (3) within mature stands (80+ years) with >60% canopy cover, and (4) within 305 m of a natural meadow of more than 4 ha.

The study area includes a diverse mixture of forest types, ranging from the Interior Valley Zone at the lowest elevations (400 m) to the mountain hemlock (*Tsuga mertensiana*) zone at the highest (2300 m; Franklin and Dyrness 1973). The dominant tree species along the gradient beginning at the lowest elevations include Oregon white oak (*Quercus garryana*), ponderosa pine, Pacific ma-

drone (*Arbutus menziesii*), Douglas-fir, California black oak (*Q. kelloggii*), white fir (*Abies concolor*), red fir (*A. magnifica*), and mountain hemlock.

From the 92 locations recorded by the BLM and USFS between 1991 and 1997, we selected the 28 sites with either nests, recently-fledged young, pairs, or multiple-year observations for habitat analysis. We defined pairs as two birds in adult plumage seen in the same location at the same time simultaneously between March and August. Because the location of a nest was not identified in the latter three categories, they are referred to as activity centers without nests. "Activity centers" may be in nesting habitat, but they potentially include foraging and roosting habitat too. By excluding single observations of lone birds, we minimized the potential of including less important habitats used by transient birds. In addition to the primary study area, we included two sites, one with a nest, located below 915 m in the foothills of the Cascades about 30 km northeast of Medford, Oregon (Fig. 1). We considered these sites because the habitat was similar to that occupied by Great Gray Owls in the Siskiyou Mountains. Also, these documented use areas are important because the current federal protocol for the Northwest Forest Plan calls for surveys for Great Gray Owls above 915 m (Huff et al. 1996).

At known nest sites, we measured habitat features centered on the nest tree. The actual nest tree at one nest site could not be relocated. For this site, we sampled habitat beginning at a point equidistant between the three likely nest trees, all of which were within 10 m of one another. For activity centers, we measured habitat features centered from the point of observation indicated by government biologists on 7.5 minute USGS topographic maps, coupled with their detailed description of the location of the bird. The sampling area consisted of a 19.95-m radius circle (0.125 ha) plus four additional 19.95-m radius plots centered 100 m from the center of the central plot in each of the cardinal directions. We recorded the identity and diameter at breast height (DBH) of live trees and snags >8 cm DBH within each plot. We measured slope and aspect at the center of each plot using a clinometer and a compass. We calculated the foliage profile at the center of each plot by measuring vegetation density in each of the four cardinal directions according to MacArthur and MacArthur (1961). We visually estimated percent canopy closure.

We measured the height of each nest and the nest tree with a clinometer. In addition, tree species, DBH, nest type, and nest placement relative to the tree were recorded. We also counted the number of stick nests within 50 m of the nest tree to determine their availability and to help identify the species that may have built the nest used by the owls. For example, a large number of stick nests within a 50 m radius would tend to eliminate accipiters as the nest builders (Reynolds and Wight 1978).

Small mammal species are often restricted to particular habitats (Verts and Carraway 1998). We analyzed the contents of Great Gray Owl pellets to gain further clues to owl habitat use. We estimated the number of prey from counts of skulls and mandibles.

We used BLM and USFS aerial photos to assess habitat within 0.8 km (2.0 km<sup>2</sup>) of each nest or observation. For each site, we used aerial photos from the year that most

closely corresponded to the year of observation (1991–96). We verified with government biologists that no habitat alteration occurred in the intervening years. After determining the scale of each photo by comparison with USGS topographic maps, we placed a 67 × 67 m grid (113 points) over the nest or point of observation and assigned each grid point to one of the following vegetation categories: closed-canopy coniferous forest, open-canopy forest, chaparral, or open areas. We defined open-canopy forest as Oregon white oak and oak/madro-ne woodland and thinned stands (hereafter partial cuts) <10 yr old. Chaparral consisted of habitats dominated by wedgeleaf ceanothus (*Ceanothus cuneatus*), whiteleaf manzanita (*Arctostaphylos vicida*) and poison oak (*Toxicodendron diversiloba*). Open areas included natural meadows, clearcuts <10 yr old, agricultural fields, and roads. We also measured the distance to the nearest clearcut or partial cut <10 yr of age and meadow >2 ha in extent. We did not consider clearcuts >10 yr of age to be open areas because the growth of young conifers and shrubs approached a closed canopy condition on most sites by this time.

Level of significance for all tests was set at  $\alpha = 0.05$ . Comparison of size composition of trees at nest sites and activity centers was initially evaluated with a Multivariate Analysis of Variance (MANOVA) using Statistica for Windows (1993). However, the assumption of equal covariance matrices was violated, thus we compared the size classes independently. Due to multiple comparisons, we used a sequential Bonferroni correction (Rice 1989). When comparing the 30 habitat features between nests and activity centers (Table 2), we employed the Mann-Whitney *U*-test when the data were not normally distributed, again using a sequential Bonferroni correction. We evaluated the elevational distribution of Great Gray Owls relative to 915 m and habitat data involving percentages using a *G*-test.

## RESULTS

Great Gray Owls were detected at 92 locations, including 10 sites with nests, five sites with fledglings but no identified nests, 10 sites with pairs but no breeding confirmed, and 67 sites with single owls confirmed in one or more years (Fig. 1). Of the 92 sites, 63% were below 915 m (Fig. 2). Of the 25 sites where nests, fledglings, or pairs were confirmed, 80% were below 915 m, with a mean elevation of  $904 \pm 397$  ( $\pm$ SD). Within the area surveyed by government biologists, a similar pattern existed indicating greater abundance below 915 m ( $G_1 = 11.32$ ,  $P < 0.001$  and  $G_1 = 9.25$ ,  $P < 0.05$  for all sites and those with a nest, fledglings, and pairs; respectively). All sites were located on public lands administered by the Medford District of the Bureau of Land Management, or the Rogue River National Forest.

Ten nests were found during the study, and another was found in 1998, when conducting follow-

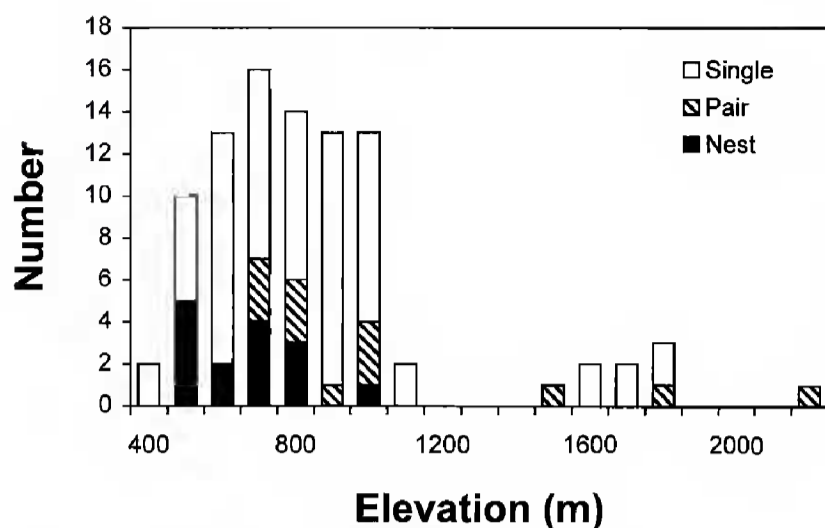


Figure 2. Elevational distribution of Great Gray Owls in the Siskiyou Mountains. "Single" represents locations of individuals observed once. "Pair" indicates locations with pairs and/or multiple-year sightings. "Nest" represents observed nests or locations of recently-fledged young.

up searches of previously used nesting sites. None of these nests were located closer than 4 km of each other. Of these, 10 were in Douglas-fir and one was in a ponderosa pine. Of 10 cases where the specific nest was identified, five were stick nests situated on lateral limbs against tree trunks, and five were stick nests in the forked top of trees. None of the nests were reused the following year. Nests were located in one of the largest trees at each site (Tables 1 and 2). The number of stick nests within 50 m of nests used by owls ranged from 2–14 ( $\bar{x} = 5.9$ ). Incubating or brooding Great Gray Owls were observed between 25 March and 12 May; the earliest fledglings were observed 14 May.

Great Gray Owls most frequently nested in late-successional stands dominated by Douglas-fir located near natural forest edges (Table 2). Nest plots typically included large trees at low densities with numerous smaller understory trees. Of the five subplots sampled at each site, basal area averaged highest on the nest plot and dropped to less than 50% on the lowest-ranked peripheral plot (Fig. 3). The decrease in Douglas-fir basal area and the corresponding increase in Oregon white oak basal area between the nest plot and the lowest-ranked peripheral plot also indicated a change in habitat within 120 m of the nest tree. Oregon white oak tends to occur in single-species or hardwood-dominated open-canopy stands and is uncommon within areas dominated by Douglas-fir.

Forest composition at nest sites was similar in most respects to activity centers without nests. The

Table 1. Characteristics of 10 nest trees used by Great Gray Owls in the Siskiyou Mountains of southwestern Oregon, 1991–97.

| FEATURE                           | MEAN | SD   | RANGE    |
|-----------------------------------|------|------|----------|
| DBH (cm) of nest tree             | 64.0 | 24.0 | 34–106.5 |
| Nest height (m)                   | 20.9 | 5.1  | 16–31    |
| Tree height (m)                   | 35.3 | 6.4  | 2–45     |
| Number of stick nests within 50 m | 5.9  | 3.6  | 2–14     |

distribution of trees in regard to six size classes did not differ ( $P \geq 0.767$ ). Of the 30 variables examined (Table 2), no significant differences between nest sites and activity centers were detected, and only two were indicated when not using the sequential Bonferroni correction (Oregon white oak density and the size of conifer snags). Because of the similarities in habitat features between nest sites and activity centers, we feel justified combining the two to characterize the habitat of Great Gray Owls in the Siskiyou Mountains (Table 2).

Both nest and all sites combined contained about 45% closed canopy forest within a 0.8 km radius (Table 3). Only four of ten nest sites and 15 of all 28 sites had clearcuts within 0.8 km. Clearcuts never accounted for more than 10% of the area at the ten nest sites.

Aspect was predominantly north, with 80% of nest sites and 67% of activity centers facing north. Overall, 20 of 28 sites had a northerly aspect ( $P < 0.02$ , binomial probability of a result this extreme or greater).

Pellets and pellet fragments were collected at 11 locations, including seven nest sites and four roosts. Of 165 prey items identified, 79.4% were located beneath nests. California voles (*Microtus californicus*) and moles (*Scapanus* spp.) were the most common prey items, comprising 63.0% of the individuals identified (Table 4). Botta's pocket gopher (*Thomomys bottae*) was the only other species accounting for >5% of the prey items.

#### DISCUSSION

Great Gray Owls of the Siskiyou Mountains most often occur in mature Douglas-fir forest close to Oregon white oak or oak/madrone woodland, chaparral, or natural meadows. The use of mature and old growth forests adjacent to open areas is similar to findings of other studies in the western United States (Forsman and Bryan 1984, Winter

Table 2. Habitat characteristics in the vicinity of 10 nest sites and 18 additional sites with fledged young, pairs, or multiple-year occupancy in the Siskiyou Mountains, 1991–97.

| FEATURE                     | NEST SITES            |     |          | ALL SITES <sup>1</sup> |     |          |
|-----------------------------|-----------------------|-----|----------|------------------------|-----|----------|
|                             | MEAN                  | SD  | RANGE    | MEAN                   | SD  | RANGE    |
| Tree density (No./ha)       |                       |     |          |                        |     |          |
| Douglas-fir                 | 251                   | 156 | 75–630   | 274                    | 165 | 0–630    |
| White fir                   | 20                    | 64  | 0–64     | 25                     | 68  | 0–245    |
| Ponderosa pine              | 11                    | 12  | 0–32     | 15                     | 23  | 0–106    |
| Other conifer               | 10                    | 19  | 0–56     | 27                     | 63  | 0–250    |
| Pacific madrone             | 74                    | 75  | 0–203    | 61                     | 63  | 0–203    |
| Oregon white oak            | 105                   | 162 | 0–547    | 49                     | 106 | 0–547    |
| California black oak        | 32                    | 30  | 0–77     | 29                     | 33  | 0–142    |
| Other hardwood              | 13                    | 16  | 0–50     | 16                     | 41  | 0–216    |
| Total                       | 518                   | 254 | 262–1062 | 497                    | 211 | 205–1062 |
| Snag density (No./ha)       |                       |     |          |                        |     |          |
| Conifer                     | 41                    | 16  | 22–74    | 43                     | 29  | 0–138    |
| Hardwood                    | 54                    | 47  | 18–171   | 36                     | 36  | 0–171    |
| Total                       | 95                    | 55  | 40–219   | 78                     | 52  | 0–219    |
| DBH live trees (cm)         |                       |     |          |                        |     |          |
| Douglas-fir                 | 31                    | 10  | 18–47    | 30                     | 10  | 13–53    |
| White fir                   | 28                    | 0   | 28       | 21                     | 8   | 10–28    |
| Ponderosa pine              | 36                    | 7   | 24–46    | 36                     | 23  | 16–125   |
| Other conifer               | 28                    | 2   | 27–30    | 23                     | 13  | 9–55     |
| Pacific madrone             | 21                    | 8   | 4–33     | 20                     | 6   | 4–33     |
| Oregon white oak            | 16                    | 5   | 11–26    | 16                     | 4   | 11–26    |
| California black oak        | 20                    | 6   | 14–31    | 19                     | 5   | 12–31    |
| Other hardwood              | 17                    | 6   | 12–27    | 15                     | 5   | 8–27     |
| Total                       | 25                    | 5   | 15–32    | 25                     | 5   | 15–32    |
| DBH snags (cm)              |                       |     |          |                        |     |          |
| Conifer                     | 26                    | 7   | 13–37    | 23                     | 7   | 11–37    |
| Hardwood                    | 15                    | 2   | 13–19    | 15                     | 3   | 10–25    |
| Total                       | 20                    | 3   | 13–27    | 19                     | 4   | 11–27    |
| Distance to water (m)       | 405 (10) <sup>2</sup> | 163 | 12–596   | 372 (28)               | 252 | 12–131   |
| Distance to timber sale (m) | 129 (4)               | 78  | 40–184   | 145 (18)               | 67  | 40–251   |
| Distance to opening (m)     | 99 (10)               | 89  | 22–313   | 103 (28)               | 87  | 0–325    |
| % canopy closure            | 65                    | 14  | 42–81    | 61                     | 19  | 9–87     |
| % slope                     | 37                    | 16  | 8–59     | 36                     | 15  | 8–65     |
| Elevation (m)               | 704                   | 161 | 512–1006 | 901                    | 391 | 427–2262 |

<sup>1</sup> “All sites” includes nest sites and other activity centers (locations with recently-fledged young, pairs, and multiple-year observations where a nest has not been located).

<sup>2</sup> Numbers in parentheses represent the number of sites at which a feature occurred within 1 km and were used in calculating the mean.

1986, Franklin 1988, Bull and Henjum 1990, Goggans and Platt 1992), but not with respect to elevation (<915 m) and not near Oregon white oak and chaparral habitat types. This suggests a wider elevational and habitat distribution than currently understood.

The nature of the openings used by Great Gray

Owls for foraging varies throughout its range in the western United States. In California, owls foraged primarily in natural meadows (Winter 1986). In contrast, owls in the Rocky Mountains and the central Cascades of Oregon foraged primarily in clearcuts (Franklin 1988, Goggans and Platt 1992). Only in northeastern Oregon, did birds hunt reg-

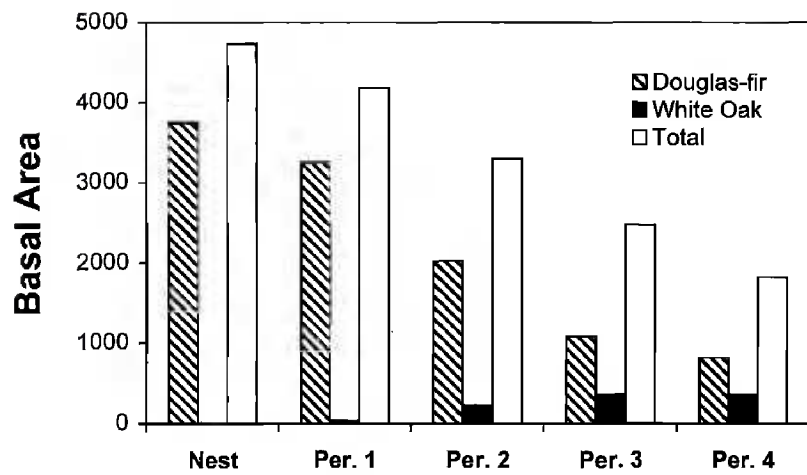


Figure 3. Basal area ( $m^2/ha$ ) of Douglas-fir, Oregon white oak, and all trees combined in the nest plot and peripheral plots (1–4) at 10 Great Gray Owl nest sites in the Siskiyou Mountains. Peripheral plots are ranked from greatest to least total basal area.

ularly in open canopy forests (Bull et al. 1988a, 1988b, 1989). In the Siskiyou, the openings in the vicinity of owl observations most often included open Oregon white oak and oak/madrone woodlands as well as chaparral and grassy meadows. Clearcuts were uncommon near owl locations, and based on prey items identified from pellets, do not appear important as foraging areas. At lower elevations in the Siskiyou Mountains, clearcuts tend

Table 3. Percent coverage of different vegetation types within a 0.8-km radius ( $2 km^2$ ) centered on the nest or point of observation of Great Gray Owls in the Siskiyou Mountains, 1991–97.

| HABITAT                              | NEST SITES | ALL SITES <sup>1</sup> |
|--------------------------------------|------------|------------------------|
| Closed-canopy coniferous forest      | 45.5       | 45.9                   |
| Open-canopy forest                   |            |                        |
| Oak and oak/madrone woodland         | 23.8       | 17.0                   |
| Partial/selective cuts               | 3.8        | 7.0                    |
| Other                                | 0          | 1.2                    |
| Total                                | 27.6       | 25.2                   |
| Chaparral                            | 12.6       | 10.3                   |
| Open                                 |            |                        |
| Natural meadows                      | 3.7        | 7.4                    |
| Recent clearcuts                     | 3.8        | 6.1                    |
| Agricultural fields                  | 4.0        | 2.0                    |
| Roads                                | 2.2        | 2.5                    |
| Total                                | 13.6       | 18.0                   |
| Other (buildings, yards, farm ponds) | 0.7        | 0.6                    |

<sup>1</sup> "All sites" includes nest sites and other activity centers (locations with recently-fledged young, pairs, and multiple-year observations where a nest has not been located).

Table 4. Prey items identified in the pellets of 11 pairs of Great Gray Owls inhabiting the Siskiyou Mountains, 1991–97.

| SPECIES                  |                                   | INDIVIDUALS | PERCENT OF TOTAL ITEMS | PERCENT OCCURRENCE <sup>1</sup> |
|--------------------------|-----------------------------------|-------------|------------------------|---------------------------------|
| Mole                     | <i>Scapanus</i> sp.               | 49          | 29.7                   | 82                              |
| Shrew-mole               | <i>Neurotrichus gibbsii</i>       | 3           | 1.8                    | 27                              |
| Shrew                    | <i>Sorex</i> sp.                  | 3           | 1.8                    | 18                              |
| Northern flying squirrel | <i>Glaucomys sabrinus</i>         | 1           | 0.6                    | 9                               |
| Botta's pocket gopher    | <i>Thomomys bottae</i>            | 16          | 9.7                    | 55                              |
| Mazama pocket gopher     | <i>Thomomys mazama</i>            | 1           | 0.6                    | 9                               |
| Deer mouse               | <i>Peromyscus maniculatus</i>     | 1           | 0.6                    | 9                               |
| Mouse                    | <i>Peromyscus</i> sp.             | 2           | 1.2                    | 9                               |
| Dusky-footed wood rat    | <i>Neotoma fuscipes</i>           | 1           | 0.6                    | 9                               |
| Wood rat                 | <i>Neotoma</i> sp.                | 1           | 0.6                    | 9                               |
| Creeping vole            | <i>Microtus oregoni</i>           | 3           | 1.8                    | 27                              |
| California vole          | <i>Microtus californicus</i>      | 56          | 33.9                   | 82                              |
| Townsend's vole          | <i>Microtus townsendii</i>        | 5           | 3.0                    | 18                              |
| Vole                     | <i>Microtus</i> sp.               | 13          | 7.9                    | 45                              |
| Red-backed vole          | <i>Clethrionomys occidentalis</i> | 2           | 1.2                    | 9                               |
| Norway rat               | <i>Rattus norvegicus</i>          | 1           | 0.6                    | 9                               |
| Unidentified mammal      |                                   | 6           | 3.6                    | 18                              |
| Dark-eyed junco          | <i>Junco hyemalis</i>             | 1           | 0.6                    | 9                               |
| Total                    |                                   | 165         | 99.8                   |                                 |

<sup>1</sup> Percent occurrence represents the percentage of sites at which a given prey type was encountered.

to be dominated by brush and young conifers before a dense herbaceous layer develops. The Great Gray Owl's principal prey, California voles, moles, and Botta's pocket gophers prefer grasslands and other habitats with abundant herbaceous vegetation such as that found in Oregon white oak and oak/madrone woodlands, as well as in grassy meadows (Bailey 1936, Ingles 1965, Maser and Storm 1970).

The diet of Great Gray Owls on our study area was similar to many previous studies, in that voles, gophers, and other small terrestrial mammals were the dominant source of food (Mikkola and Sulkava 1970, Mikkola 1972, Winter 1986, Franklin 1988, Bull and Henjum 1990). The abundance of moles in the diet, however, is higher than reported in other studies. The dominance of these small terrestrial mammals in the diet suggests that the owls were foraging in the more open oak/madrone woodland and grassy areas. Because of their large size (410–465 mm wing chord; Johnsgard 1988), we believe that Great Gray Owls are unable to forage efficiently in dense forest habitats, and are best adapted to hunt edges and open forests.

The elevational distribution of Great Gray Owls in the Siskiyou Mountains is unique in the western United States. In other locations, almost all owls have been reported above 915 m (Forsman and Bryan 1984, Franklin 1988, Bull and Henjum 1990). The few observations below 915 m were attributed to dispersing juveniles, non-breeders, and wintering birds (Winter 1986, Goggans and Platt 1992). The lowest reported nesting was 912 m (Goggans and Platt 1992). By comparison, only one of the 11 nests in this study was above 825 m.

The distribution of suitable habitat in the Siskiyou may explain the large number of owls observed at low elevations. Below 915 m, mature Douglas-fir forests on north-facing slopes often occur in close proximity to Oregon white oak-dominated woodlands, chaparral and/or natural meadows on adjacent south-facing slopes. In these areas, Douglas-fir stands offer roosting and nesting sites while the open woodlands and meadows offer opportunities for foraging. Oak woodlands tend to support a dense herbaceous layer, and numerous hunting perches which are important to Great Gray Owls (Bull and Henjum 1990). Above 915 m in the Siskiyou, vegetation is dominated by coniferous forests, with few oak woodlands or open grasslands, though clearcuts are widespread.

Great Gray Owls appear to be opportunistic re-

garding nest selection, using whichever nest type is available, including artificial nest platforms (Nero 1980, Mikkola 1983, Bull and Duncan 1993, Whitfield and Gaffney 1997, Duncan 1997). At low elevations in the Siskiyou, platform nests were abundant in most stands where owls nested. Owls nested in one of the largest trees (top 10%) in each stand illustrating the importance of mature stands. The location and structure of stick nests used by the owls led us to believe that most of the nests were constructed by western gray squirrels (*Sciurus griseus*), which tend to be associated with oak woodlands or with the interface between oak woodlands and coniferous forests (Bailey 1936, Cross 1969, Maser 1998, Verts and Carraway 1998). This habitat is common below 1000 m on the northern slopes of the Siskiyou Mountains. The abundance of potential nest sites may explain why nests were not reused in subsequent years.

Another potential factor affecting the elevational distribution of Great Gray Owls is temperature. Winter (1986) speculated that Great Gray Owls do not nest at lower elevations in the southern portion of their range because they are adapted to boreal forests and are physiologically unable to occupy areas with high temperatures. Our observations suggest that the southern limits of the range may have more to do with the distribution of suitable habitat than with temperature *per se*. All nests that we located occurred at elevations where mean maximum temperatures exceeded 32°C during the summer months, and where temperatures on some summer days surpassed 40°C (Taylor 2001). Cloud cover and precipitation provide limited relief during the breeding season with less than 3 cm of precipitation in each April and May and even less in the summer months (Taylor 2001). However, all nests in the Siskiyou Mountains were shielded from direct sunlight by canopy cover, in contrast to the exposed broken-top snag nests found in California (Winter 1986).

Great Gray Owls regularly occur below 915 m in the Siskiyou Mountains where suitable habitat is available. As such, a reassessment of the current protocol used by the USFS and BLM to monitor Great Gray Owls in the Pacific Northwest in terms of conducting surveys only above 915 m (3000 ft) seems appropriate. Thus, Great Gray Owls may occur elsewhere in the western United States at elevations lower than previously recorded where shaded nesting sites are available.

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